Alaska Fisheries Science Center
Resource Assessment and Conservation
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CRUISE RESULTS

CRUISE 2001-01
CHARTERED F/V's *MORNING STAR*, AND *VESTERAALEN*
2001 GULF OF ALASKA BIENNIAL GROUNDFISH ASSESSMENT SURVEY
MAY 17 - JULY 25, 2001

The second biennial bottom trawl survey of Gulf of Alaska (GOA) groundfish resources was conducted from May 17 through July 25, 2001 by the Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC), Seattle, Washington. Unlike the 1999 survey which sampled the entire GOA to 1,000 m depths, 60 fewer available vessel days in 2001 restricted sampling to 500 m depths in the central and western GOA.

Prior to the first biennial survey conducted in 1999, GOA groundfish resources had been surveyed by the RACE Division on a triennial schedule with surveys conducted in 1984, 1987, 1990, 1993 and 1996. Each of these surveys covered the entire continental shelf to 500 m depths but only the 1984 and 1987 surveys included deeper stations to 1,000 m. It is anticipated that the 2003 survey will resume sampling the geographic and depth range assessed in 1984, 1987 and again in 1999.

ITINERARY

Survey sampling was conducted aboard the chartered commercial trawlers *Vesteraalen,* and *Morning Star*. The 70-day survey period was divided into four legs of 17-18 days each and staffed by scientific personnel from the AFSC and other cooperating agencies and institutions (Table 1). Sampling operations began near the Islands of Four Mountains (170° W longitude) and extended eastward on the continental shelf to the eastern boundary of the central GOA off Prince William Sound (147° W longitude). Sampling occurred at pre-selected stations, or nearby alternate stations, in depths ranging from 20 m to 448 m (Figure 1).

May 17	First day of charter. Load equipment, supplies and sampling gear aboard survey vessels in Dutch Harbor, AK.
May 20	Begin sampling survey stations at Islands of Four Mountains.

June 3	Arrive Sand Point, AK. Exchange scientific personnel.
June 4	Begin Leg 2 - Vessels depart Sand Point and resume survey eastward.
June 20	Arrive Kodiak, AK. Exchange scientific personnel.
June 21	Begin Leg 3 - Vessels depart Kodiak and resume survey.
July 7	Arrive Kodiak, AK. Exchange scientific personnel.
July 8	Begin Leg 4 - Vessels depart Kodiak and resume survey.
July 23	Arrive Kodiak, AK. Unload vessels.
July 25	Last day of charter.

OBJECTIVES

The primary focus of the biennial groundfish assessment surveys is to build a standardized time series of data to describe and monitor the distribution, abundance, and biological condition of GOA groundfish stocks. Specific objectives of the 2001 survey were to:

- Describe the distribution and relative abundance of the principal groundfish and invertebrate species inhabiting the GOA;
- Collect data to define various species-specific biological parameters *i.e.*, age, sex, size, growth rates, length-weight relationships, and feeding habits;
- Collect integrated net configuration and position data for all trawl hauls to obtain precise area-swept estimates;
- Record surface-to-bottom water column temperatures; and,
- Perform special collections as requested by cooperating research groups and agencies.

VESSELS AND GEAR

The *Vesteraalen* and *Morning Star*, are both house-forward trawlers with stern ramps, multiple net storage reels (mounted forward of the working deck and/or aft over the stern ramp), telescoping deck cranes, propeller nozzles, and paired, controlled-tension hydraulic trawl winches with 1,280 -2,190 m of 2.54 cm diameter steel cable. The *Vesteraalen* is 38 m in overall length (LOA) and powered by a single, 1,700 continuous horsepower (HP) main engine. The *Morning Star* is 45 m LOA and also propelled by a 1,700 HP main engine. Each vessel is equipped with a full complement of state-of-the-art navigational and fishing electronics including Global Positioning Systems (GPS) with video position plotters, radars, color video fish-finders, and recording depth sounders.

Each vessel's crew consisted of the captain, lead fisherman, engineer-fisherman, fisherman and

cook-fisherman. Captain Tim Cosgrove operated the *Vesteraalen* for the first two legs followed by Captain Brad Lougheed for the last two legs. The *Morning Star* was operated by Captain Tim Carrier for the first two legs followed by Captain Scott Clark for the last two legs.

Standard RACE Division Poly-Nor'eastern high opening bottom trawls, rigged with roller gear, were used exclusively for sampling the selected survey stations. The standard survey trawl has a 27.2 m headrope with twenty-one 30 cm diameter floats, and a 24.3 m, 1.3 cm diameter longlink alloy chain "fishing line" attached to a 24.9 m, 0.95 cm diameter 6 x 19 galvanized steel wire footrope. The roller gear is 24.2 m long and constructed of 1.9 cm diameter 6 x 19 galvanized steel wire rope and 36 cm rubber bobbins separated by a solid string of 10 cm rubber disks. In addition, 5.9 m wire rope extensions with 10 cm and 20 cm rubber disks were used to span each lower flying wing section.

The trawls are constructed with 12.7 cm stretched-mesh polyethylene web with a 3.2 cm stretched-mesh nylon liner in the codend. The trawl bridles consist of triple 54.9 m, 1.6 cm diameter galvanized wire rope. Chain extensions to the dandylines are 46 cm and 23 cm at the headrope and side panel attachments, respectively. Steel, 1.83 x 2.74 m V-doors weighing approximately 800 kg each were used to spread the net. The fishing dimensions of the trawls were measured using Scanmar[1] acoustic net mensuration equipment.

SURVEY AREA

The standard GOA survey area (as assessed in 1999) encompasses an area of 320 thousand km^2. The continental shelf waters shallower than 200 m represent approximately 73 percent of the total survey area while the 300-1,000 m slope depths account for 27 percent. In contrast, the truncated 2001 survey encompassed a total area of 221 thousand km^2 of which 85 percent was represented by continental shelf waters shallower than 200 m and 15 percent by 200-500 m depths.

SURVEY DESIGN AND METHODS

Similar to previous surveys of the same area, the 2001 GOA survey employed a stratified-random design utilizing 32 strata based on the 100, 200, 300 and 500 m bathymetric contours, major geographic features such as banks and gullies, and International North Pacific Fishery Commission (INPFC) regulatory areas. A modified Neyman optimum allocation strategy using data from previous GOA surveys was used to allocate effort between strata. Optimum allocation calculations were made for each of the principal groundfish species in each survey year based on that year's survey data and the estimated time to perform a tow in a given

[1] Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

stratum as the cost variable (deeper tows take longer to execute, therefore cost more). A mean of the resulting proportions was then calculated, resulting in an estimate of optimal allocation for each of the principal groundfish species. A weighted mean of these values was then calculated using each species' current ex-vessel value as the weighting variable. This resulted in the proportion of total survey effort to be allocated to each stratum. This was then multiplied by the estimated available effort (total number of tows) to calculate the number of tows to be assigned to each stratum.

The target on-bottom duration for a standard trawl haul is 15 minutes. Trawling time on bottom was estimated during the tow using real-time net configuration data (wingspread and headrope height) acoustically transmitted to the vessel. GPS data were collected every two seconds throughout the tow. Temperature and depth were recorded every six seconds by a micro-bathythermograph attached to the trawl headrope. A bottom contact device, utilizing a tilt sensor attached to the fishing line to detect contact with the bottom, collected data every six seconds. The final tow durations, start and end times and geographical positions were estimated from all available information collected from each tow.

The operational guidelines for completing a standard survey tow are:

- 15 minutes towing time (distance fished approximately 0.74 nm (1.4 km) at a speed of approximately 3 knots).
- Appropriate towing wire deployed as specified in the standard survey scope table. The goal of each tow was to not exceed 10 m of depth change over the 15 minute towing period. In areas where this was not possible, trawl warp was adjusted during the tow to reflect the changing depth.
- Net mensuration indicates fishing gear operating within normal limits, taking into account that the net width tends to increase and net height decreases with increased amount of deployed cable.
- Survey gear in continuous contact with the bottom.
- No significant hang ups, gear damage or gear conflicts (e.g. crab pots).

Catches were sorted to species, weighed and enumerated according to standard RACE Division protocol. Extensive size composition data were collected with barcode based recording devices and downloaded to computer database files after each tow. A variety of biological data including age structures (mostly otoliths), lengths, and weights of individual specimens were collected and entered in the computer database.

Special collection requests from researchers within the AFSC Groundfish Program, other research units, agencies and educational institutions included:

- **Rockfish (*Sebastes*) species and lingcod (*Ophiodon elongatus*):** Tissue samples to examine stock structure and population genetics (AFSC, Auke Bay Laboratory).

- **Rougheye rockfish (*Sebastes aleutianus*):** Specimens from waters shallower than 200 m and west of 155 W. longitude for genetics research (AFSC, RACE Division and Auke Bay Laboratory).

- **Pacific ocean perch (*Sebastes alutus*), northern rockfish (*Sebastes borealis*) and rougheye rockfish:** Heart samples as part of a coast-wide genetic study (AFSC, Auke Bay Laboratory.

- **Bigmouth sculpin (*Hemitripterus bolini*):** Demersal egg-masses to augment early life history development studies (AFSC, RACE Division).

- **Non-Liparis snailfishes and lumpsuckers:** Specimens under 10 cm for laboratory identification and systematic studies (AFSC, RACE Division, Groundfish).

- **Walleye pollock (*Theragra chalcogramma*):** Juvenile specimen collections for research into the timing of the first annulus formation (AFSC, RACE Division, FOCI).

- **Shortraker rockfish (*Sebastes borealis*):** Specimens less than 30 cm for age and growth studies (AFSC, REFM Division, Age and Growth).

- **Pacific ocean perch:** Juvenile specimens to 20 cm for age and growth studies (AFSC, REFM Division, Age and Growth).

- **Assorted fishes** including miscellaneous rockfishes and flatfishes, Atka mackerel (*Pleurogrammus monopterygius*), sablefish (*Anoplopoma fimbria*), tomcod (*Microgadus proximus*), and small ling cod for observer training (AFSC, REFM Division, Observer Program).

- **General invertebrates:** Representatives from the California Academy of Sciences and the Smithsonian Institution collected various invertebrate species to augment the identification process and for archival purposes.

- **Food Habits:** Food habits personnel conducted special collections along with the general food habits collections. The special collection sampled all marine fish species at two stations per leg (AFSC, Resource Ecology and Ecosystem Modeling Program).

- **Fish Lice (Argulus Spp.)** Crustacean specimens of the genus Argulus which typically parasitize the body surfaces of various groundfish and salmon species (Southern Illinois University).

RESULTS

Sampling proceeded from west to east. Some pre-assigned stations were not sampled due to unsuitable bottom conditions. In cases where trawlable bottom could not be found at a given station, an alternate location was sampled. Of the 528 standard survey tows attempted , 489 tows, ranging in depth from 20 m to 448 m, were successfully completed.

Throughout the survey, biological data were collected from many species with length measurements being the most common. Nearly 135 thousand fish representing 62 species were measured for length including approximately 35 thousand arrowtooth flounder, 13 thousand pollock, 13 thousand rock sole (northern and southern combined), 12 thousand flathead sole, 9 thousand Pacific ocean perch, 8 thousand rex sole, 7 thousand Pacific cod and 6 thousand Pacific halibut (Table 2). Approximately 16 thousand otoliths were collected from 18 species along with 13 thousand length-weight observations representing 33 species. In addition, a total of 123 fish and 270 invertebrates were collected and vouchered for systematics analysis and identification.

Arrowtooth flounder was by far the most abundant species in the survey area followed by Pacific ocean perch, northern rockfish, Pacific cod, and walleye pollock (Table 2). Walleye pollock continued a decade-long downward trend in abundance, declining from 783 thousand t in 1990 to 593 thousand t in 1999 and 209 thousand t in 2001 (Table 3). The 2001 pollock biomass distribution exhibited a 41/59 percent split between the western and central GOA respectively. While the 1999 size composition included many 35- 60 cm fish, the 2001 population contained far fewer larger fish but many more smaller fish less than 20 cm.

Pacific cod declined 10 percent from 285 thousand t in 1999 to 256 thousand t in 2001 which was relatively evenly divided between the western and central GOA. The arrowtooth flounder biomass estimate of nearly 1.4 million t represents a 41 percent increase over the 1999 estimate encompassing the same area. Nearly 93 percent of the arrowtooth biomass came from the central GOA survey area. The second-most abundant species was Pacific ocean perch (POP) with a biomass estimate of 712 thousand t, a 10 percent increase from the 1999 survey. POP was relatively evenly distributed between the central (60%) and western (40%) GOA. Northern rockfish, with a biomass estimate of 344 thousand t, ranked third in abundance, a 47% increase over the 1999 estimate. Nearly 74 percent of the northern rockfish biomass was located in the central GOA survey area. Pacific halibut, the fourth most abundant species, had a similar biomass distribution with 73 percent of the 347 thousand t estimate also occurring in the central GOA.

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Table 1.– Scientific Staff and Affiliations for the 2001 Gulf of Alaska Biennial Groundfish Assessment Survey of the western and central Gulf of Alaska (bolded name indicates Field Party Chief).

	Leg 1	**Leg 2**	**Leg 3**	**Leg 4**
Vesteraalen	**Bill Flerx**	**Bill Flerx**	**Jay Orr**	**Bill Flerx**
	Paul von Szalay	Nate Raring	Lyle Britt	Skip Zenger